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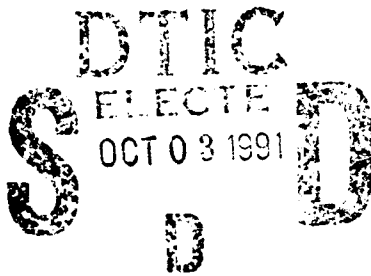
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Work Standards, Productivity, and Quality

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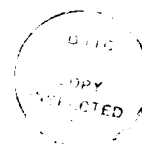
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13. ABSTRACT *(Maximum 200 words)*

W. Edwards Deming claims that standards should be eliminated because they focus on the quantity of work produced to the detriment of work quality. The present study examined the effects of production standards on work quantity and quality. Thirty-seven employees were hired to perform a "database management" task in a simulated work environment. The first week was the baseline period for productivity (keystrokes per hour) and work quality (percent key entry errors). During the second week, the workers were divided into two control groups and four experimental groups. The control groups differed only in that one group received feedback on its productivity and the other group received no feedback. The four experimental groups represented four levels of work standards (80%, 90%, 110%, and 120% of baseline). The workers were divided into underachievers and overachievers. The underachievers showed a marked increase in keystrokes per hour as the standards increased. Key entry errors for underachievers and overachievers were unaffected by the standards, except that the overachievers made more errors than the underachievers for the moderately high (110%) standard. In general, there was no evidence that productivity increases were related to declines in work quality. Responses to job satisfaction and stress questions revealed no differences between any of the groups. Specific task strategies were identified that might explain how workers were able to increase production without sacrificing quality.

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FOREWORD

The project reported here investigated the effect of production standards on work quantity and quality. The project was conducted in the Navy Personnel Research and Development Center's Organizational Systems Simulation Laboratory (OSSLAB). The project was originally an Exploratory Development Program entitled "Improving Individual and Unit Productivity" (PE0602233, Project RM33M20, Task 8) and was later sponsored under the Independent Research/Independent Exploratory Development (IR/IED) Work Unit 0602936N-RV36120.

This report is one in a series of publications investigating the relationships of incentives, standards, and feedback to job performance and satisfaction in a simulated organizational setting. Technical reports have been published on the relationships between performance, incentives, job satisfaction, and stress (NPRDC-TR-87-29 and NPRDC-TR-87-30); goal setting (NPRDC-TR-87-15), and work strategies (IIFOSL-TN-72-86-05). This work has also been documented in professional journals and in papers at various conferences.

The research described in this report provides important new knowledge to aid in the development of Total Quality Management (TQM) and goal setting systems within the Department of the Navy. Without the theoretical knowledge provided by OSSLAB research, implementation of such systems would be less effective.

Requests for information concerning this report should be directed to Dr. Delbert M. Nebeker, AUTOVON 553-7966 or (619) 553-7966.

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SUMMARY

Problem

Productivity growth is declining in American industry. This decline is found in the Navy's industrial activities as well as in the private sector. W. Edwards Deming (1982, 1986) has outlined a theory of Total Quality Management (TQM) that has met with some success in improving productivity and quality in both the public and private sectors. One of Deming's more controversial recommendations is to eliminate numerical goals and work standards. Because this is such a controversial recommendation, the present study attempted to test some of the assumptions that underlie Deming's recommendations.

Purpose

The purpose of this study was to test two of Deming's assertions with respect to goals and standards: (a) that the introduction of high quantity production standards will lead to lower work quality (Deming, 1986, pp. 67-69), and (b) that workers assigned low standards will lower their quantitative output (Deming, 1986, pp. 71-72).

Approach

Thirty-seven employees were hired to perform a data entry task in a simulated work environment. Half the workers were assigned to two control groups in which no work standards were imposed. The remaining employees were assigned to one of four groups representing varying production standards, ranging from very low to very high. Data were collected on the workers' productivity (keystrokes per hour), work quality (key entry errors), and responses to a questionnaire.

Results and Conclusions

The data revealed several important relationships. (a) Assigning production standards to workers had little effect on the quality of the work; quality remained high for all but one group (overachievers working under a moderately high standard). (b) The workers classified as underachievers responded positively to increased work standards (i.e., their productivity went up as the standards increased), but the overachievers responded negatively to the increased standards, with productivity decreasing. (c) Workers assigned the lowest standards did not lower their productivity relative to the control groups (i.e., the low standards group did not work down to the standard). (d) The workers assigned standards adopted different work strategies than workers in the control groups. (e) Job satisfaction and job stress were unrelated to either achievement or the work standards.

These data tend not to support any sweeping criticism of numerical goals and standards. On the other hand, goals and standards are not necessarily effective for all

workers. The data suggest that overachievers are not as productive when assigned high standards, and they tend to lower their work quality when assigned moderately high standards. The underachievers, by contrast, are more productive when given high quantitative standards and these standards do not degrade work quality.

Recommendations

1. Standards and goals should not be eliminated from Navy industrial settings by managers and program directors, provided that the conditions outlined in this report and by Locke and Latham (1984) are met. Some of the more important conditions include (a) specifying the nature of the task, (b) specifying how performance will be measured, (c) specifying the target values of performance in quantitative terms, and (d) providing adequate feedback.

2. Under the conditions that existed in this study (i.e., quality was clearly and explicitly defined), workers did not sacrifice quality to meet a production goal. Additional studies in both laboratory and field settings should be conducted to determine under what conditions workers would lower the quality of their work to achieve a production goal.

3. More research is needed on the complex interrelationships between goal setting and development of work strategies.

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INTRODUCTION

Problem

According to some observers we are experiencing a crisis in American industry. We are losing our status as one of the most productive nations in the world and are having an increasingly difficult time producing quality goods and competing in the world marketplace. Many explanations have been offered for this state of affairs and many solutions have been proposed. One approach that has captured the imagination of many American managers is the Total Quality Management (TQM) philosophy of W. Edwards Deming. Deming (1982, 1986) has outlined 14 points that express his principles for achieving improved quality and productivity. Two of these 14 points--eliminate numerical goals and eliminate standards--are especially controversial because these recommendations run contrary to a vast amount of research on goal setting and industrial engineering methods.

Purpose

The purpose of this research was to test Deming's (1986, pp. 65-77) two points regarding the deleterious effects of goals and standards on quality and productivity. Because the suggestion that business and industry eliminate goals and standards is contradictory to much of contemporary organizational theory, a fair and impartial test of Deming's two points is a critical first step in evaluating his general TQM approach. The research reported here is an attempt to clarify Deming's points and contrast them to the other points of view that seem to contradict his position. The opposing views are then tested in an organizational simulation and the results are discussed with an eye toward resolving these apparent contradictions.

Background

W. Edwards Deming is probably best known as the American whose philosophy and methods were largely responsible for the success of Japanese industry today (Gitlow & Gitlow, 1987, p. 7). The *sine qua non* of Deming's philosophy is quality. Quality is achieved through never-ending improvement in the company's process, which includes not only the manpower, methods, materials, and machines, but also the suppliers, customers, investors, and the larger community. Deming argues that improving quality through process control will improve productivity because of increased uniformity of the product; less rework and fewer mistakes; and reduced waste of manpower, machine-time, and materials. Other benefits of improved quality, according to Deming, are lower costs, better competitive position, more jobs, and happier workers.

Deming's principal objection to setting numerical goals is that these goals are usually arbitrary and emphasize quantity rather than quality. But, even when these goals are not arbitrary and do focus on quality, Deming still objects to their use because the employee often is handicapped by a process that does not provide the method and means

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to achieve the goal. For example, establishing a goal of "zero defects" can have no beneficial effect unless the system is also changed to allow the goal to be reached. These changes may come from changes in the incoming material so it is not defective, or keeping the machines in working order, or keeping the measuring instruments properly calibrated (Deming, 1982, p. 37). In fact, such a goal as "zero defects" may have a negative effect if the workers become frustrated over their inability to meet the demands. Deming also argues that goals are often met with mistrust and resentment by workers who feel that these goals will eventually be replaced by new and higher goals.

Deming is not opposed to all goals. He acknowledges that people set goals for themselves and these goals and deadlines are a necessary part of accomplishing many tasks in life (Deming, 1982, p. 38; Deming, 1986, p. 69). What Deming objects to is arbitrary, quantitatively-oriented goals that provide no "road map" for their attainment. If the goals were based on realistic values that emphasize quality over quantity, and if the goals included suggestions on how they could be accomplished, then Deming would have less objection to them (Deming, 1982, p. 40).

Deming's reservations about the use of work standards are similar to his objections to numerical goals: They are arbitrarily (and often inaccurately) established; they focus on productivity to the detriment of quality; they are set within a process that creates barriers to the workers in their attempt to meet the standard; by themselves, they give workers no guidance on how to reach the standard; and they are subject to periodic increases by management when the workers consistently meet them. Add to this list of problems the following: (a) Workers are often demoralized by their inability to meet the standard; (b) the pressure to produce larger quantities of a product frequently leads workers to skimp on the quality, and thus undermines their pride of workmanship; and (c) standards and quotas that are too low sometimes lead to a situation where the employees will horde parts, or slack off on their work when the quotas are met, or simply work down to the standard (Deming, 1982, pp. 40-47; Deming, 1986, pp. 65-77; Gitlow & Gitlow, 1987, pp. 164-16).

These criticisms are a serious indictment of goals and standards, but within the context of Deming's theory of TQM they are well developed. If Deming's criticisms are valid, one wonders why Management By Objectives (MBO), goal setting, and industrial engineering standards have continued to be used so extensively by American business and industry. Perhaps the reason is because there is strong evidence that goals and standards do, in fact, lead to marked improvement of task performance. Several reviews of the literature on goal setting show a consistent picture of hard, difficult goals and high standards leading to large improvements in both the quantitative and qualitative dimensions of task performance (e.g., Latham & Lee, 1985; Locke, Shaw, Saari, & Latham, 1981; Mento, Steel, & Karren, 1987). The many studies done in this area have demonstrated this pattern in both laboratory and field settings and have examined such varied tasks as chess, arithmetic problems, logging, truck driving, dieting, and returning

survey questionnaires. Moreover, many of these studies have also found that difficult goals and high standards are associated with high levels of job satisfaction.

Locke and Lat' .n (1984) are most forceful in their insistence that goal setting is a technique that wo:'.., and they provide a clear program for implementing this technique. These researchers argue that if goal setting is used properly, American business and industry can expect significant improvements in both product quantity and quality. Their formula for the successful implementation of goal setting involves the following basic s:.· ₃ and set of conditions: (a) Get both the organization and the employees committed to a fair trial of the goal setting process; (b) specify the nature of the task(s) to be accomplished; (c) specify how performance is to be measured; (d) specify the target or standard quantitatively in terms of its importance and difficulty; (e) state the "action plans" (i.e., the means by which the goals or standards can be accomplished); and (f) provide adequate feedback to the workers on how well they are doing relative to the goals.

The goal setting program outlined by Locke and Latham works, according to them, for many reasons. First, gaining a commitment from both the organization and the employee ensures that proper instruction, training, resources, policies, and support exist, and that there are no impediments to the program. Second, by specifying the tasks, the performance, and the standards, management is clarifying its work expectations and providing the employee with direction. Third, the very presence of goals, especially difficult (but reasonable) goals, encourages people to try harder and persist longer at a task. Fourth, people gain a sense of accomplishment, efficacy, and closure from attaining goals. Fifth, action plans and feedback give the employee the means to accomplish the goals and the information necessary to take corrective action when the goals are not met.

Approach

It is clear that the dismal view of goals and standards presented by Deming and the optimistic view of goals and standards articulated by Locke and others are in conflict. Although the two positions become less diametrical when all of the assumptions, conditions, and presuppositions of both positions are made explicit, there is nonetheless a basic philosophical difference between the two approaches. Deming believes that in all but the most unusual of circumstances, production goals and standards lead to a deterioration in quality and, in the case where the standards are too low, diminished productivity (Deming, 1986, pp. 69, 71, 72). Locke and others believe that goal setting is a fundamental process in human motivation and that setting production goals leads to increased productivity without sacrificing quality.

The present research was designed to test Deming's position by addressing two main questions: (a) Does the introduction of numerical production standards lead to a lowering of work quality? (b) Does the assignment of low production standards lead workers to retard their production (i.e., work down to the standard)? In addition, the

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research attempted to address two subordinate questions: (c) Do workers assigned standards employ different work strategies than workers not assigned standards? (d) What effects do standards have on the workers' job satisfaction?

METHOD

Research Design and Overview

College students were hired as "data base operators" to enter and maintain a computerized data base. For this task they were paid an hourly rate of $5.11. The employees worked 4 days a week, 4 hours a day, over a period of 2 weeks in a simulated organizational setting. The data base consisted of references to professional articles and books taken from the personal libraries of researchers at the Navy Personnel Research and Development Center (NAVPERSRANDCEN). Applicants for the job were aware that it was temporary work. The simulated work setting allowed for greater experimental control than that found in a field setting, and allowed for greater generalizability than that afforded by a typical university laboratory. Also, the employment period was relatively long (2 weeks), thus negating some of the problems associated with short-term laboratory studies.

The research design was a 2 x 6 mixed factorial design. The within-subject factor was the work week (first week versus second week). The first week was a baseline period for all subjects and the second week was the treatment period. The between-subject factor was six levels of performance standards introduced during the second week.

The six levels of the between-subject factor consisted of two control groups and four standards groups. The two control groups were not assigned standards during the second (treatment) week. The second control group differed from the first in that this second group received performance feedback throughout both the baseline and the treatment periods. This performance feedback was in the form of reports (to be discussed in greater detail later) that provided such information as record counts, keystroke counts, and keystroke rates.

The remaining four groups were assigned work standards during the second (treatment) week. These standards groups consisted of two groups who received high standards and two groups who received low standards. The two high standards groups were created by dividing a single group of workers into two subgroups and assigning one subgroup a very high standard (120% of its average baseline performance) and another subgroup a moderately high standard (110% of its average baseline performance). The two low standards groups were created in a similar fashion, resulting in a very low standard subgroup (80% of its average baseline performance) and a moderately low standard subgroup (90% of its average baseline performance). All four standards groups were treated identically to the second control group during the baseline period (i.e., all groups received performance feedback but were not assigned standards). During the

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treatment period the standards groups were given additional feedback in their reports that indicated their performance relative to the work standard assigned.

There were two work samples obtained from all workers. Each worker was asked to enter a batch of seven journal references into the computer; the seven were identical for all employees. The first sample was obtained at the end of the first day and the second sample was obtained on the last day of the baseline period (Day 4). In addition, on the last work day (Day 8) the workers were asked to complete a questionnaire that covered many different facets of the job.

There were two supervisors assigned to the groups; they alternated between morning and afternoon shifts to balance the influence that the supervisors might have on the experimental conditions. Data were continuously and automatically collected by the computer software and included such measures as time spent on tasks, time and frequency of rest breaks, total keystrokes, keystrokes per hour, and number of completed batches of work. Table 1 provides a summary of the major design features of this study.

Table 1
Summary of Major Design Features

Experimental Condition	n	Baseline (Days 1-4)	Treatment (Days 5-8)	Day Off	Work Shift
Control Group I (no feedback/no standard)	9	12/30/85-1/3/86	1/6/86-1/10/86	Wed.	7:30-11:30 a.m.
Control Group II (feedback/no standard)	9	12/30/85-1/3/86	1/6/86-1/10/86	Wed.	12:00-4:00 p.m.
High Standards Groups					
Very High	4	1/14/86-1/17/86	1/21/86-1/24/86	Mon.	7:30-11:30 a.m.
Moderately High	5	1/14/86-1/17/86	1/21/86-1/24/86	Mon.	7:30-11:30 a.m.
Low Standards Groups					
Very Low	5	1/14/86-1/17/86	1/21/86-1/24/86	Mon.	12:00-4:00 p.m.
Moderately Low	5	1/14/86-1/17/86	1/21/86-1/24/86	Mon.	12:00-4:00 p.m.

Subjects

Workers were recruited through a local university foundation by the posting of notices at employment offices at a number of local universities and by advertising in a campus newspaper. An attempt was made to randomly assign workers to the experimental conditions, but that was not possible because the researchers had to make accommodations to individual schedules. Only applicants having a self-reported typing speed of 30 words per minute (WPM) were to be used as candidates. However, because of a clerical error, five workers were selected who had speeds under 30 WPM. Typing speed ranged from 10 to 70 WPM, with an average of 40 WPM for all workers.

Thirty-seven college students were hired as employees to perform the data base task. (The design originally called for 40 workers, but three workers were unable to complete the experiment.) Roughly half of the 37 workers ($n = 18$) were in the two control groups, with 9 workers in the first control group and 9 in the second. The remaining half of the workers were in the standards groups, with 9 workers in the high standards groups and 10 in the low standards groups. Because there was not an even number of workers in the high standards groups ($n = 9$), only 4 workers were assigned to the very high standards subgroup. There were 5 workers in each of the other subgroups (moderately high, moderately low, and very low). The ages of the workers ranged from 19 to 31, with an average age of 22.4 years. Half of the workers were female and half were male. The educational level ranged from less than one year of college to postgraduate. Sixty-one percent were Caucasian, 13 percent were Asian, 8 percent were Black, and 8 percent were Hispanic.

Apparatus

Computer Hardware

Each employee was assigned to a workstation equipped with an IBM-XT microcomputer with 640 kilobytes (KB) of random access memory (RAM); one floppy disk drive; one 10-megabyte (MB) hard disk drive; an IBM monochrome monitor; and a non-glare screen. A supervisor's workstation was separately configured with an IBM-PC with 640 KB of RAM; 2 floppy drives; an expansion cabinet with two 10-MB hard disks; and an IBM monochrome monitor with a non-glare screen.

Computer Software

Original computer software was written to accomplish three tasks: (a) data base management, (b) response capturing, and (c) performance reporting and analysis. The data base programs were written in d-BASE II programming language and utilized a number of programs specifically designed for this task. Individual responses were collected by programs written in both BASIC and MACRO ASSEMBLER languages, and the performance reporting and analysis software was written in BASIC.

Employee Workstations

All the employees on a shift worked together in an L-shaped room that offered approximately 30 sq. ft. of work area per employee. Heating and air conditioning systems were used to maintain a comfortable work environment. Eight of the workstations were arranged along both walls of the leg of the L while another four were arranged along one wall of the base of the L. A supervisor's workstation was situated at the juncture of the leg and the base of the L. There were 12 workstations (not including the supervisor's station), but no more than 10 of these were in use during any shift. The tables and chairs were ergonomically designed for comfortable seating.

Procedure

Overview of Task

The data base was composed of reference articles from the personal libraries of research professionals employed by the NAVPERSRANDCEN. The workers were required to enter into the computer pertinent material from these reference articles using photocopies of the first page of each article. Articles were grouped together into work batches, with 30 articles to a batch. The front page of each batch was a batch cover sheet that contained the batch identification, location of the original articles, and several other items of information used by the researchers. The actual entry process consisted of the employees typing in such information as author(s), title of reference source, article title, year, volume, key words, and location of reference.

Training and Work Sample

On the first day the employees were welcomed to the job and the organization by a person identified as a second-level supervisor. This person explained the general purpose of the organization and gave them an overview of their work task, its value to the research organization, and the importance of maintaining high levels of quality (i.e., the entries had to be accurate or the researchers who used this data base would not be able to locate the references). At the conclusion of this briefing he introduced the workers to their supervisor and training was conducted by the supervisor.

Training required approximately 3 hours during the first work day. Employees were given a training manual that explained the purpose of their work and contained examples of the various software "menus" necessary for the work task. These manuals were kept at each worker's workstation for easy reference. The supervisor read through the training manual with each group. Each worker then, for practice, entered seven reference examples given in the training manual.

At the end of the training period each employee was asked to enter a work sample containing an additional seven selected journal articles as a maximum performance test to be used to assess the worker's ability. The employees were told to do their very best on

this test because it was being given to ensure that they could perform the task both quickly and accurately. The employees were led to believe that if they did not perform adequately on the work sample they could be terminated from the job. No employee was terminated due to their work sample results. Upon completion of the work sample, employees began their regular work task of entering reference articles.

Work Sessions

Employees worked for 4 hours a day, 4 days a week, over a period of 2 weeks, for a total of 32 work hours per employee. The workers were divided into four shifts. The first two shifts consisted of the two control group workers. The first control group (no feedback) worked from 7:30 - 11:30 a.m., and the second control group (feedback) worked from 12:00 - 4:00 p.m. These control shifts worked a total of 8 days (4 days per week), with each Wednesday being a nonwork day.

The other two shifts worked the subsequent two weeks and were made up of the high and low standards groups. The high standards workers worked from 7:30 - 11:30 a.m., and the low standards workers worked from 12:00 - 4:00 p.m. These workers also worked a total of 8 days (4 days per week), with each Monday being a nonwork day. (It was decided to make Monday the nonwork day to give the researchers one working day between the end of the first two shifts and the beginning of the next two shifts to install the software and make other changes for these new workers.) As explained above, the high standards workers were divided into two subgroups (very high standard and moderately high standard) and the low standards workers were divided into two subgroups (very low standard and moderately low standard).

There was no actual contact between employees from the different shifts. The workers in a particular shift knew there were other shifts of workers doing the same type of work, but they were unaware of any of the experimental treatments that differentiated the groups. Although the workers in the standards groups knew that the standards were tailored to each individual, they were not told that the standards varied from high to low.

After the end of training on the first day, the work sessions followed a regular pattern. Employees would sit at their workstations where the day's work had already been distributed (usually 3-5 batches) and enter reference articles. In some cases the employees would work on modifying and correcting references based on their own judgment that they had made errors on previous entries. Employees were allowed to take rest breaks whenever they wanted, but were urged not to abuse the privilege. The typical work pattern was interrupted only three times. The first interruption was on the fourth day (the last day of the baseline period) when the employees were given a second work sample identical to the first work sample. The next two interruptions were by a researcher not directly connected with the day-to-day work who explained the standards at the start of the second week and administered a questionnaire at the end of the job.

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Performance Feedback

The second control group and all of the standards groups had available to them three different types of performance reports: (a) task reports that displayed performance information on individual tasks, such as entering journal references, correcting references, or modifying references; (b) batch reports that displayed performance information accumulated over a work batch that could include information about several different tasks; and (c) progress reports (see Figure 1) that displayed performance information accumulated over the work day as v. ll as performance totals accumulated over past work days.

PROGRESS REPORT

USER ID TATUM   DATE 01/05/86

START TIME 10:17:16   STOP TIME 10:49:58

	RECORD COUNT	KEY COUNT	KEY TIME	KEY RATE
PROGRESS	3	499	0.063	7959
TO DATE	3	689	0.082	6555
	YOUR BEST PROGRESS			7959

	PROD HRS	REG HRS	EXPND HRS	REG PAY
PROGRESS	0.066	0.434	0.434	$2.17
TO DATE	0.066	0.434	0.434	$2.17

BREAKDOWN OF INDIVIDUAL TASKS IN PROGRESS

	REC	KEY CNT	TASK TIME	KEY RT	BEST RT
TECH	1	323	0.020	6555	
TO DATE	1	323	0.020	6555	6555
JOURNAL	1	176	0.043	7959	
TO DATE	2	376	0.019	7000	7959

Figure 1. Sample progress report used during the first week (baseline) as feedback to data base operators.

These reports were generated by the computer software and were automatically updated on a regular basis. Employees could look at these reports at any time during the work day. These reports contained information concerning a number of relevant performance dimensions, including number of references entered, keystrokes per hour, hours actually clocked in at work, etc. See Figure 1 for an example. The reports

contained information for that particular day and for the worker's past performance. These reports were modified after the first week for the standards groups to include other information relevant to the standards (e.g., keystrokes per hour as a percent of the standard rate).

Performance Standards

The standards were introduced on the first day of the second week. Employees were told that the standards were based on their work from the previous week and each standard was tailored to the individual (i.e., no two individuals would have the same standard). It was explained to the workers that standards were a common part of many jobs and that they should use these standards to judge how well they were performing on the job. No details on exactly how the standards were derived were given to the workers other than to say that they were based on performance during the first week. In fact, the standards were based on the worker's average performance during the first week, and were set at one of four levels. The very high standards were set at 120 percent of this average, the moderately high standards were set at 110 percent, the moderately low standards were set at 90 percent, and the very low standards were set at 80 percent.

Questionnaire

On the last day of work, a researcher not directly connected with the day-to-day work asked the employees to complete a questionnaire. The researchers explained that the questionnaire would aid him in learning how workers viewed this job in particular and in gathering information that might be applicable to other jobs. It was explained to the workers that they were not obliged to answer the questions, and if a worker did not want to complete the questionnaire, he or she could continue the regular work. Workers would be paid their regular hourly rate for completing the questionnaire. All employees present agreed to answer the questions. After employees had completed an informed consent form, the questionnaire was administered to the workers on the computer and the data were collected by the computer. Of the 37 workers, 3 workers (1 in the first control group and 2 in the second control group) were absent on the last day. No attempt was made to transmit these questionnaires to those workers by other means, such as through the mail. The following kinds of data were collected on the 34 remaining workers (see Appendix A for a copy of the actual questions).

Job Satisfaction and Stress

This set of questions dealt with employees' job satisfaction and sources of job stress. Questions 2-26 covered subscales taken from various sources. These subscales were: (a) General Satisfaction (questions 2-4) taken from Cook, Hepworth, Wall, and Warr (1981, p. 31); (b) Coworker Satisfaction (questions 5-7), (c) Pay Satisfaction (questions 8-9), and (d) Internal Satisfaction (the work itself) (questions 10-12) taken from Szilagyi and Wallace (1980); (e) Job Pressure (questions 13-16) and (f) Workload Stress (questions 17-20) adapted from Cooper, Nebeker, and Riedel (1987); and (g)

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Perceived Stress (questions 21-26) and (h) Equity (questions 27-30) created by the authors to explore more personal aspects of stress and address issues of fairness and job equity.

Work Performance and Effort Estimates

These items asked the workers to estimate their actual work performance (average keystroke rate) for the past 2 weeks (questions 31-32) and to estimate how hard they actually worked during the past 2 weeks (questions 33-34).

Work Strategies

These questions were based on the taxonomy of work strategies developed by Tatum, Nebeker, Cooper, and Riedel (1986). The questions asked the workers to identify and judge their use of task and support strategies.

Task Strategies. There are two types of task strategies described by Tatum et al. (1986):

1. **Motor strategies** (questions 35-36) refer to motor activities (hand motions or eye movements) that should aid in the performance of the task.

2. **Cognitive strategies** refer to various cognitive activities that should facilitate task performance. In the present case, there were two forms of cognitive strategies measured: (a) Chunking (questions 38-45), which is the capacity to organize small bits of information into larger units (see Charness, 1981; McKeithen, Reitman, Rueter, & Hirtle, 1981, for other examples); and (b) automaticity (questions 46-67), which is the capacity to enter data in an automatic, noncontrolled fashion (see Shiffrin & Schneider, 1977, for a more complete description of controlled versus automatic processing).

Support Strategies. There are six support strategies outlined by Tatum et al. (1986). In general, each of these support strategies serves as a method by which the workers can support the skills and abilities needed to perform a task and maintain a suitable work environment.

1. **Rest periods** (questions 68-75) are those times when a worker takes a break from the task. The questions asked the worker to estimate the length and frequency of these breaks for both the first and the second week (the software also recorded the amount of time the workers spent on work breaks). The questions also asked about the reasons for taking work breaks and where these breaks were spent.

2. **Pace** refers to the speed at which workers perform the task and their persistence at the task. The dimension of speed was measured by questions 76-78, which asked the workers to estimate their keystroke rate at their slowest, normal, and fastest pace.

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Persistence was measured by question 79, which asked the workers to estimate the variability in their pace.

3. **Time management** refers to how the workers use their time on the job to accomplish the various facets of the work. Questions 80 and 81 asked about time used in the correction of errors during the first and second weeks.

4. **Resource management** is the use of job resources to accomplish the required tasks. For the present study there were four general categories of resources. The keys on the keyboard comprised one kind of resource, and the workers were asked to estimate the frequency with which they used critical keys (use per hour) for the first and second weeks (questions 82-101). The work manual, the supervisor, and coworkers represented other categories of work resources, and the workers were asked to estimate the frequency with which they used these resources (use per day) for the first and second weeks (questions 102-107).

5. **Goal setting** is a strategy by which workers can focus their activities on important dimensions of the task and not waste time on peripheral task characteristics. Questions 108-132 dealt with various goals that employees set for themselves, but only questions 117-119 were analyzed in this study.

6. **Feedback** means here the monitoring and seeking out of available performance feedback by the workers as a way to support and improve task performance. Questions 133-145 asked the workers who received feedback reports (i.e., the second control group and the standards groups) about when they used the performance reports, which reports they used most often, how they used the reports, how often they examined reports, what information they found most useful, and how often they requested a printed copy of the report. The software also recorded the amount of time the workers spent examining reports.

Background Data

Background questions (146-160) concerned such variables as age, gender, race, and education level.

External Validity

Questions 161-162 were included as checks on whether the simulation provided a realistic work setting.

RESULTS AND DISCUSSION

Productivity

The data most pertinent to the study were the productivity measures and the quality measures. The productivity measures are therefore discussed first. Because approximately 90 percent of all the work performed involved the entering of journal articles into the computer, we excluded the other tasks from the analysis to create a more homogeneous set of data. Consequently, the basis for the productivity measures was keystroke rate (keystrokes per hour) on the journal entries only. This measure was a highly reliable measure of productivity. Using the keystroke rate for each work day as an item, we calculated Cronbach's Coefficient of Alpha for both the first week (Days 2-4) and the second week (Days 6-8). The coefficients were .97 and .95 for the first and second weeks, respectively.

Note that keystroke rate represents the traditional approach to measuring productivity (i. e., output divided by input). Although some, including Deming, would fairly argue that the concept of productivity should include quality, we chose to use the more traditional definition so that we could compare productivity and quality.

The most important question in this research with regard to productivity was whether the different standards influenced productivity. Such an influence would be reflected by a change in productivity during the second week when the standards were introduced. More specifically, the expectation was that the groups who were assigned work standards would perform differently from either of the control groups who were not assigned standards.

The productivity results for the second week are shown in Figure 2, which plots keystrokes per hour along the ordinate and the four standards groups along the abscissa. The plot excludes day 5 (the first day of the second week) because this was the day the standards were introduced and was a period of transition for the workers. The classification into underachievers and overachievers, as shown in Figure 2, is based on an analysis of the workers' baseline (first week) performance relative to their ability. Regression analysis was used to predict baseline performance from ability (the scores on the second work sample) for each worker. When the predicted scores were compared with the actual baseline scores, the workers fell along a continuum of achievement. Those workers whose actual baseline performance was well below the predicted performance were the underachievers. Those whose actual baseline performance was well above the predicted performance were the overachievers. For the purposes of analysis, the achievement continuum was divided at the median, with those workers who were below the median classified as underachievers and those above the median classified as overachievers. The control groups were combined into a single group (statistical analyses revealed no differences between the groups); their average productivity is displayed in Figure 2 as a single dashed line.
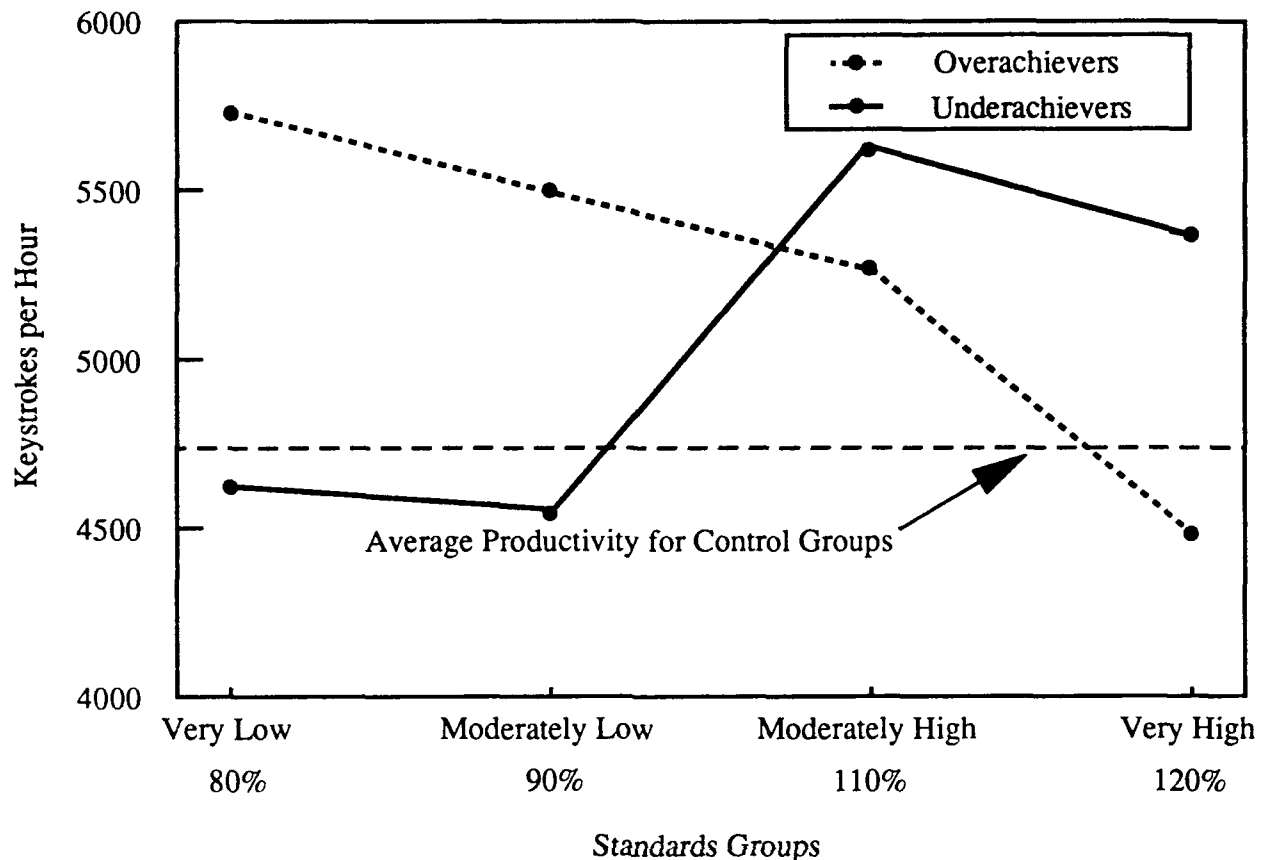
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Figure 2. Work productivity for the standards groups as a function of achievement (overachievers vs. underachievers).

It is not appropriate to compare the groups on their second week's performance without first demonstrating that these groups did not differ on their first week's performance. Because the groups were, for the most part, treated identically during the first week, they should not have differed with respect to the productivity measure during that week. For the purpose of analysis, the data were organized by worker and work day such that the adjusted keystroke rate for each subject/day observation was a unit of analysis. A regression analysis was performed on the keystroke rates for the first week (Day 1 was excluded because training was performed on this day) using groups as the predictor variable. The results of this analysis failed to reach statistical significance, F (5, 105) = 1.29, $p > .05$, thus indicating that there were no productivity differences between the groups during the first week.

A second regression analysis was performed on the keystroke rate for the second week (Day 5 was excluded) using the second work sample (ability), achievement (overachievers and underachievers), and the groups (four standards and two controls) as predictors. The results of this second analysis revealed that the interaction between groups and achievement was significant, F (15, 95) = 2.66, $p < .05$. This interaction

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accounted for 10 percent of the remaining variance after the main effects (i.e., ability, achievement, and groups) and two-way interactions were entered into the regression equation. Subsequent comparisons revealed two important things. First, in no instance did any of the standards groups perform significantly below the control groups ($p > .05$). Second, the four standards groups were significantly differeAt from each other, but, as shown in Figure 2, the nature of this difference depended upon whether the workers were underachievers or overachievers. The underachievers in the two high standards groups were significantly more productive than the workers in the control groups ($p < .05$). The overachievers showed almost the reverse pattern. The overachievers in all the standards groups except the very high group were significantly more productive than the control workers ($p < .05$). The fact that productivity for the overachievers actually declined with the higher standard may indicate that the overachievers became discouraged and refused to perform at the higher standard. This possibility is discussed later when the job satisfaction data are described.

Quality

We turn next to the measure of work quality. Because most of the references had been previously entered several times into the computer data base, we had available a "purified" data base in which we could verify that the entries were error-free. We were then able to compare the entries from our workers in this experiment with the purified data base and calculate measures of work quality. We selected as our measure of quality the percentage of unmatched characters for all of the data base fields. In other words, for all of the fields (author, title, journal, etc.) a computer program compared the worker's entries with the purified entries, character by character, and calculated the percent of incorrect characters. This percent of incorrect characters (error rate) was then converted using an arc sine transformation as recommended by Cohen and Cohen (1983, pp. 265-267). These transformed error rates were reasonably reliable measures. Using the arc sine transformation of the error rate for each work day as an item, we calculated Cronbach's Coefficient of Alpha for both the first week (Days 2-4) and the second week (Days 6-8). The coefficients were .67 and .83 for the first and second weeks, respectively.

Figure 3 plots work quality (error rates) for the second week (Day 5 was excluded) for the four standards groups and the two levels of achievement. Regression analyses were performed on the arc sine transformation of these error rates. The regression analysis on the quality scores from the first week failed to reveal any significant group effect, $F (5, 105) < 1.00$. For the second week, there was a significant interaction between groups and achievement, $F (15, 95) = 3.87, p < .05$. This interaction accounted for 15 percent of the remaining variance after the main effects (i.e., ability, achievement, and groups) and two-way interactions were entered into the regression equation. Inspection of Figure 3 reveals that this interaction reflects a small, but significant, difference between the overachievers and the underachievers in the moderately high standards condition ($p < .05$). For whatever reason, the overachievers had lower quality

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data entries (higher error rates) than the underachievers when they were assigned a moderately high standard.
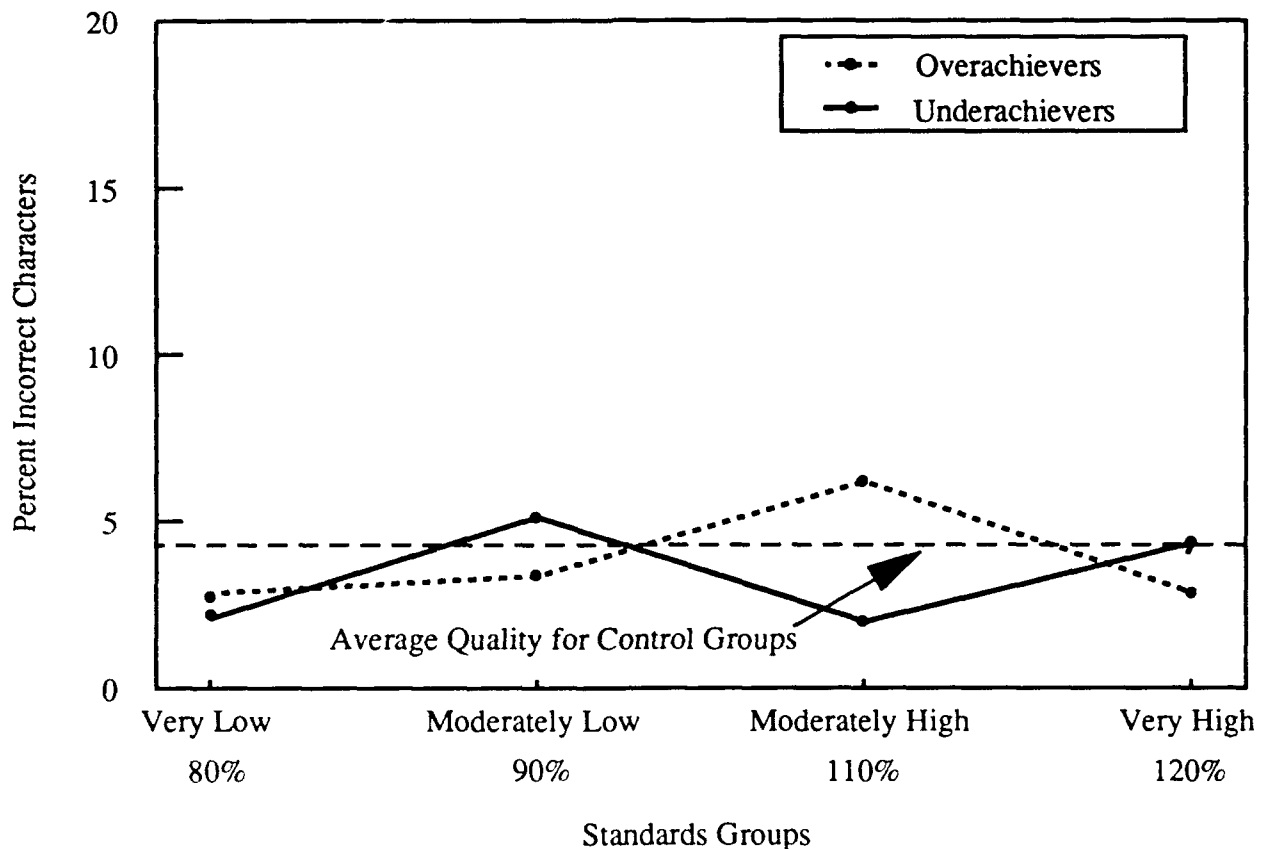

Figure 3. Work quality for the standards groups as a function of achievement (overachievers vs. underachievers).

The results for work quality do not map neatly on to the productivity results. The productivity of the overachievers and underachievers was markedly different for the various standards conditions. For the most part, the work quality of the overachievers was the same as for the underachievers. The single exception was when the overachievers were working under the moderately high standard; under that condition they made more errors than the underachievers ($p < .05$). The effects of standards and achievement on productivity (Figure 2) appear to be unrelated to the effects these variables had on work quality (Figure 3).

Effort and Strategies

The overall correlation between productivity and quality was small, albeit significant ($r = -.21$, $p < .05$). The negative sign indicated that as the keystroke rate increased, the proportion of data entry errors decreased. Apparently, higher performing workers were able, by some means, to type faster without sacrificing quality. Perhaps

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workers increased their efforts or devised work strategies that allowed them to increase the quantity of their work without deceasing the quality. The following results relate to these possibilities.

To simplify the presentation, the six groups (two controls and four standards) were combined into three groups. The two control groups were combined into a single "control" group, the two low standards groups were combined into a single "low standards" group, and the two high standards groups were combined into a single "high standards" group. Although some information was lost by these combinations, the general pattern of the results was preserved.

We took up first the issue of the amount of effort the workers expended on the task. Certain questionnaire items (questions 33 and 34 in Appendix A) asked the workers to estimate how hard they worked. The workers were asked to rate on a scale ranging from 0 to 100 the amount of effort they put forth on the job during both the first and second weeks. The ratings for the second week were adjusted by using the first week's ratings as a covariate in a regression analysis. The predicted score from this regression analysis was subtracted from the actual score from the second week to obtain a "residual gain" score. This residual gain score was then added to the average rating for the second week and was used as the criterion variable in a regression analysis with groups (low standards, control, and high standards) and achievement (overachievers and underachievers) as the predictor variables. The regression analysis failed to show any statistically significant main effects or interactions with respect to effort ($p > .05$). In other words, effort, measured in this way, did not account for the differences we observed in performance.

Because the workers did not differ in terms of the amount of effort they reported, we turned then to see whether the workers used different strategies that might explain the productivity differences. The reader is directed to Appendix B for a description of how each strategy was measured and analyzed. The questionnaire covered many measures of work strategy. For the purposes of this study, strategies were divided into two basic categories--task strategies and support strategies (Tatum et al., 1986)--and the results are presented according to this classification. It should be noted that very often the workers were asked about their strategies for both the first week and the second week. When this occurred, the measure used for analysis was a residual gain score created in the same fashion as described above for the effort measure. Sometimes it was impractical to obtain two measures (first week and second week) for a particular strategy, and for these measures no adjusted score was available. Table 2 shows the different strategies available to the workers and gives the results for each of the three groups. Generally speaking, there was no effect of achievement on strategy and so these relationships were not reported. Table 2 also shows the type of measurement scale used for each of the strategies and which items on the questionnaire (if any) related to the strategy.

Table 2
Work Strategy Values for the Low Standards, Control,
and High Standards Groups

			Group		
Measure	Scale	Question Nos. (Appendix A)	Low Standards	Control	High Standards
Task strategies					
Hand position	% Ss	35	.30	.40	.67
Eye movements	% Ss	36	.20	.40	.78*
Chunking	0-100	38-45	61.10	63.50	56.50
Automaticity	1-5	46-67	2.92*	3.29	3.48
Support strategies					
Rest periods (obj.)	min.	NA	19.60*	11.80	15.20
Rest periods (subj.)	min.	68-71	22.05	13.66	15.73
Pace	key/hr.	76-78	4157.00*	5096.00	4758.00
Persistence	1-15	79	7.40	8.90	7.20
Time mgmt	% Ss	80-81	.10*	.47	.00*
Resource mgmt	number/hr.	82-107	28.54	26.19	23.79
Self-set goals	key/hr.	117-119	4937.00	5286.00	5188.00
Feedback	min.	NA	2.10	2.10	2.90

Note. An asterisk refers to the fact that the standards group (high or low) was significantly different from the control group.
* $p < .05$.

The general pattern of results from Table 2 clearly shows that standards (both high and low) influenced the strategies people adopted in performing this task. On some occasions the high standards group demonstrated a strategy significantly superior to that of the control group (i.e., superior eye movements and time management). The low standards group usually demonstrated strategies inferior to those of the control group (i.e., in terms of automaticity, rest periods, and pace), but with respect to time management the vast majority selected the superior strategy (i.e., correcting mistakes as they occur). Of course, there were strategies over which the groups did not differ. The nonsignificant results notwithstanding, the general pattern of the findings indicates that the workers in the high standards groups tended to adopt preferred work strategies, whereas the workers in the low standards groups adopted poor work strategies.

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Table 3
Relationships Between Work Strategies, Productivity, and Quality

Measure	Productivity Correlations	Quality Correlations
Task Strategies		
Hand position	.45*	.02
Eye movements	.46*	.04
Chunking	.10	.11
Automaticity	.34*	-.14
Support Strategies		
Rest periods (objective)	.12	-.03
Rest periods (subjective)	.06	-.02
Pace	-.24	.10
Persistence	.12	-.03
Time management	-.05	-.08
Resource management	-.02	.04
Self-set goals	-.08	-.21
Feedback	-.07	-.14

* $p < .05$.

Table 3 shows how strategies were related to both productivity and quality. An examination of Table 3 reveals that the task and support strategies were not related at all to the quality measure, but that three of the four task strategies were significantly related to productivity. The results from Table 3 suggest that the task strategies are central to explaining productivity differences between the groups.

Job Satisfaction and Stress

The last set of results to be discussed concerns the data relating to job satisfaction and stress. The questionnaire presented 29 questions (questions 2-30) organized into eight different scales (General Satisfaction, Coworker Satisfaction, Pay Satisfaction, Internal Satisfaction, Job Pressure, Workload Stress, Perceived Stress, and Equity). The reliabilities of these scales (Cronbach's Coefficient of Alpha) ranged from .37 (Coworker Satisfaction) to .90 (General Satisfaction). None of these measures of satisfaction showed any relationship to the independent variables in this study at an acceptable level of statistical significance ($p > .05$).

CONCLUSIONS

The results of this study suggest that neither Deming's theory of TQM nor goal setting theory provides a complete description of the effects of work standards and goals on performance. The results showed that most workers assigned high standards did not sacrifice the quality of their work to meet the high production standard. The only exception were overachievers in the moderately high standards group who made more errors than the underachievers in the same group. Also, the workers assigned the low work standards were not less productive than the control groups who received no standards (i.e., they did not work down to the standard). Expressed another way, we found very little evidence that it was harmful to assign standards; when the standards were high, only the overachievers lowered their quality, and when the standards were low the workers did at least as well as the no standards control groups. These findings suggest that Deming's (1982, 1986) criticism of work standards and goals is an incomplete description of their effects on individual productivity and work quality, at least within the conditions that existed in this study.

Many of the conditions that Deming claims undermine quality were present in this study: (a) The standards focused on quantity rather than quality; (b) the standards were arbitrary in the sense that the workers did not have any choice in their selection and the levels were arbitrarily assigned to the different groups; (c) the standards were not accompanied by any instructions, or "road map," on how the goals might be achieved; and (d) the workers were not given any assurances that the goals would not be replaced by even higher goals later. Under these conditions, high standards actually led to improved productivity for some workers (the underachievers) without a corresponding decrease in quality. This finding suggests that Deming's criticism of work standards, goals, and quotas is not altogether justified. Of course, raising doubts about two points in Deming's theory does not destroy the entire edifice of TQM. It is still possible that, even without these two points, TQM offers a management paradigm that is more useful than other extant paradigms.

To some professionals, the finding that high quantitative goals do not necessarily lead to lowered quality might come as a surprise. There are studies demonstrating that people will lower the quality of their work to meet quantitative goals or high task demands (e.g., Bavelas & Lee, 1978; Rosswork, 1977; Sales, 1970; but also see Shaw, 1984), and there are other studies indicating that people have lower intrinsic motivation and creativity when they are evaluated by some external criterion (e.g., Amabile, 1979; Leper, Green, & Nisbett, 1973; Shalley & Oldham, 1985; White & Owen, 1970; but see Shalley, Oldham, & Porac, 1987, for some negative findings). Why should the present study run counter to these studies? There are many subtle differences between the present research and these other studies, but perhaps the clearest distinctions are that, in the present study, (a) the standards were objectively stated (explicit keystroke rates), (b) the importance and definition of quality were very clear (entries must be accurate if future users of the data base are to be successful at locating references), and (c) the

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quality of the work was under the control of the employee to some degree (i.e., the worker could correct mistakes as they occurred or could return to an entry and make corrections). It seems reasonable to us that when these three conditions prevail, people are willing to try to reach externally imposed goals without lowering the quality of their work (see Shaw, 1984).

How were the workers able to increase their productivity without lowering their quality? If people simply type faster without changing other dimensions of their work behavior, it is likely that they will make more errors. The results from the work strategy data suggest that the increases in productivity were achieved not by simply typing faster, but by changing the patterns of their work (adopting different work strategies). In particular, the results indicate that certain task strategies (i.e., eye movements and automatic processing) were significantly related to productivity and the levels of the standards. For example, those people in the high standards group who were able to increase their productivity without lowering their quality may have done so by adopting a more efficient eye movement pattern (e.g., looking from the document to the screen rather than from document to keyboard to screen). Of course, these data are correlational in nature and there may be alternative explanations. Nevertheless, these data are consistent with the results of other studies that show that workers will develop strategies and creative approaches to tasks when attempting to meet a standard or goal (cf., Chaney, 1969; Shaw, 1984; Stedry, & Kay, 1964; Terborg, 1976).

It is curious that only the task strategies, and not the support strategies, were related to both productivity and the standards. Perhaps it takes longer for support strategies to develop, and over longer periods of time people would begin to improve productivity by more efficiently scheduling work breaks, managing resources, monitoring feedback, etc. At any rate, the strategy data suggest that there are ways of increasing the quantity of a product without necessarily lowering the quality, and that these processes are under the control of the worker.

The results of this study partially support the more positive view of goals and standards presented by Locke and Latham (1984). Some workers (the underachievers) assigned high standards were more productive than either workers assigned low standards or workers not given any standards at all. Obviously, if the standards are viewed as assigned goals, then the results for the underachievers fit nicely within goal setting theories. Moreover, the findings that (a) quantitative standards did not influence quality and (b) that workers assigned low standards did not perform below the control workers (no assigned standards) are consistent with certain views of goal setting theorists (e.g., Pritchard & Curts, 1973; Shaw, 1984; Stedry & Kay, 1966; Steers & Porter, 1974). It should be noted, however, that the overachievers' failure to respond to the higher goals by increasing their productivity is not consistent with goal setting theory.

There is another anomaly with respect to goal setting theory that must be addressed. The anomaly has to do with the self-reported production goals. Just short of

half the workers ($n = 16$) reported setting a specific production goal for themselves. The results revealed that the workers in the high standards group did not set significantly higher production goals than the workers in the control group (see Table 2), and that those workers who set more difficult goals were no more productive than those who set easier goals (Table 3). These findings run counter to goal setting theory, which maintains that workers will set their own goals at levels comparable with assigned goals, and specific/difficult goals lead to improved performance over general/easy goals (see Locke, 1968; Locke, Frederick, Buckner, & Bobko, 1984; Locke et al., 1981). Possibly the workers who set specific goals were just not committed to achieving those goals. Locke (1968) and Hollenbeck and Klein (1987) have argued that goal setting is more effective when people are highly committed to attaining the goals. Unfortunately we did not take measures of goal commitment in this study and so we cannot be certain if our workers were operating at low levels in this regard. Our presumption would be, however, that the commitment to the self-set goals would be at least as strong as the commitment to the assigned standard. But, whereas the high assigned standards led to improved performance (at least for the underachievers), the high self-reported goals did not. Truly these data present a challenge to goal setting theory.

It would have been interesting to see how achievement (overachievers versus underachievers) related to self-set goals, but unfortunately there were too few workers who reported self-set goals ($n = 16$) to permit a meaningful comparison on the achievement variable. One hypothesis for future research is that underachievers in a high standards group will set higher goals than underachievers in a control group, and that underachievers who set high goals for themselves will be more productive.

In summary, our findings did not fully support either goal setting theory or Deming's (1982, 1986) theory of TQM. The fact that the underachievers improved their productivity without sacrificing quality when assigned a high production standard was not consistent with TQM. The fact that the overachievers failed to respond to the very high standard and increase their productivity was not consistent with goal setting theory. Deming's theory may offer an explanation for the results for the overachievers. Deming claims that workers assigned high production standards may become resentful and demoralized. This may be especially true for the overachievers because these were the workers who were already working very hard during the first week, and it seems reasonable that they might become resentful when asked to work even harder during the second week. Crawford, White, and Magnusson (1983) proposed a similar explanation when they found that the high performers in their study did not improve their performance when assigned high goals. Unfortunately, the results from the job satisfaction and stress questions in this study failed to reveal any differences between the groups. Perhaps a more sensitive set of measurements might reveal satisfaction or stress effects not revealed by the instruments used in the present study.

The productivity differences between underachievers and overachievers not only have theoretical interest, these findings have practical significance as well. Although the

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combined effects of standards and achievement did not account for a large amount of the variance in productivity (about 10%), the actual changes in keystrokes per hour were quite impressive. Inspection of Figure 2 shows that the underachievers in the high standards groups had a key rate that was about 900 keystrokes per hour faster than the underachievers in the low standards groups (about a 20% improvement). By contrast, the overachievers in the highest standards group were about 1,100 keystrokes per hour slower than the overachievers in the lowest standards group (about a 25% decrease). Obviously, work standards can have powerful effects on worker productivity. Of course, one must be cautious in how work standards are applied in a practical work environment, especially when dealing with high performers and high achievers. If the standards are too high there is a risk that productivity may decline for the high achievers, as it did in this study. Figure 3 suggests that, if only moderate standards are used, there is the risk that the overachievers might lower their quality.

RECOMMENDATIONS

1. Standards and goals should continue to be used in industrial settings by managers and program directors, provided that they meet the conditions outlined in this report and by Locke and Latham (1984). Some of the more important conditions include (a) specifying the nature of the task, (b) specifying how performance is to be measured, (c) specifying the target values in quantitative terms, and (d) providing adequate feedback. The present study indicated that workers assigned even very low standards will perform at levels comparable to workers not assigned any standards at all. We did not find any adverse effects resulting from the imposition of work standards, with the possible exception that moderately high standards may lead the overachiever to lower work quality.

2. Additional studies (both in the laboratory and in the field) should be conducted to determine under what conditions workers will lower their quality to achieve a production goal. This study suggests that workers will not skimp on quality if the goal is specific, the importance and definition of quality are clearly stated, and quality is under the control of the worker to some degree.

3. More research is needed on the complex interrelationships between goal setting and strategy development. The present study has merely scratched the surface, and several basic issues need to be addressed: (a) How do standards (both high and low) direct the selection of strategies? (b) Why do self-reported goals, functioning as strategies, have different effects on productivity than do externally imposed standards? (c) Is there a direct connection between work strategies and performance or are there intervening and moderating processes? Tatum et al. (1986) address several of the above issues, but clearly more conceptual and empirical work is needed.

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APPENDIX A

PRINTED VERSION OF COMPUTERIZED QUESTIONNAIRE
GIVEN TO SUBJECTS EMPLOYED AS DATA BASE OPERATORS IN A
SIMULATED WORK ENVIRONMENT

ASPECTS OF WORK

The following questions ask how you feel about various aspects of your job. Using the scale provided with each question, type in a number from 1 to 5 which best represents how you feel.

1. SAMPLE QUESTION: This job has been a good experience for me

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

2. All in all, I am satisfied with this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

3. In general, I don't like this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

4. In general, I like working here

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

5. My coworkers are usually uncooperative

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

6. In general, I am satisfied with the relationship I have with my coworkers

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

7. My coworkers make my job more pleasant

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

8. I am satisfied with my pay

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

9. I am not paid enough for my level of performance

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

10. This job does not challenge me

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

11. This job gives me a sense of accomplishment

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

12. This work is interesting

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

13. This job requires me to work very fast

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

14. This job requires me to work very hard

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

15. There is a great deal of work for me to do

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

16. There is constant pressure on me to increase my productivity

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

17. The time requirements for me to finish my work are realistic

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

18. I dislike the amount of work I am expected to do

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

19. I am dissatisfied with the pace of my work

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

20. I am unhappy about my current work load

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

21. This job sometimes leaves me badly flustered and jittery

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

22. I frequently leave work upset, angry, or irritable because of something that happened here

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

23. I often leave work with a feeling of satisfaction over work well done

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

24. I frequently get discouraged with this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

25. I am generally happy and cheerful when on this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

26. I worry a lot about this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

27. There are many things that are unfair about this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

28. Some of my coworkers get treated better than I do

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

29. I am expected to work harder than many of my coworkers

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

30. I believe that everyone gets treated equally on this job

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

WORK PERFORMANCE ESTIMATES

The following questions ask you to estimate your current work performance. Answer the questions by giving your best guess as to how you have actually been performing the job.

31. During the first week of this job what would you say your average keystrokes per hour were while entering JOURNAL REFERENCES? (Remember that the average worker does about 4000 keystrokes per hour which is about 30 words per minute.)

Type keystrokes per hour and then press ENTER

32. During the last week of this job what would you say your average keystrokes per hour were while entering JOURNAL REFERENCES? (Remember that the average worker does about 4000 keystrokes per hour which is about 30 words per minute.)

Type keystrokes per hour and then press ENTER

33. During the first week of this job how hard on the average did you work?

Think of this scale as a percentage of your capacity to put forth effort. Zero means you put forth no effort, 100 means you're working as hard as you possibly can (100% of your capacity).

The absolute minimum of my capacity										The absolute maximum of my capacity
0	10	20	30	40	50	60	70	80	90	100

Type in a number from 0 to 100 and then press ENTER

34. During the last week of this job how hard on the average did you work?

Think of this scale as a percentage of your capacity to put forth effort. Zero means you put forth no effort, 100 means you're working as hard as you possibly can (100% of your capacity).

The absolute minimum   The absolute maximum
of my capacity   of my capacity

   0   10   20   30   40   50   60   70   80   90   100

Type in a number from 0 to 100 and then press ENTER

TYPING TECHNIQUES

The following questions ask you about specific techniques you might have used when you were working at the keyboard. Please type the appropriate number for the situation or description which applies to you. Please feel free to elaborate on any of these questions by using the note pad at your desk. Any comments you have about improving the work or work environment are most welcome.

35. Which of the following best describes the way you preferred to positioned your hands and fingers. (1) typed with all ten fingers on the home row with the heels of my hands up, (2) typed with all ten fingers while resting the heels of my hands on the edge of the desk, (3) used both hands to type but did not use all ten fingers, (4) used one hand to mark my place on the document and typed with the other hand, (5) other (enter the number 5 and explain on the pad at your desk).

Type your response and then press ENTER

36. Which of the following best describes your eye-hand coordination while you entered documents. (1) looked from the document to the keyboard and back, (2) looked from the document to the screen and back, (3) looked at the document only, (4) looked from the document to the keyboard to the screen (not necessarily in that order), (5) other (enter the number 5 and explain on the pad at your desk).

Type your response and then press ENTER

A-9

CHUNKING

Sometimes pieces of information occur together in clusters or groups. We have found that some workers can enter the separate pieces as if they were one large piece. For example, most people can type the separate letters T-H-E as a single unit THE almost 100% of the time. However, most people never type the letters Y-A-R-M-E-L-K-E in YARMELKE as a single unit. What follows is a list of ways in which information can be grouped when entering data in the different fields of the data base. For each grouping, think about how you enter data in that field and estimate the percentage of time you can type the separate pieces as one large chunk or cluster.

Sample Question

37. LETTERS-->WORD: Think about typing a note to your best friend. On the scale below, estimate the percent of the time (on the average) you tend to type the separate letters of a word as if they were a single chunk of information and not individual letters (e.g., T-H-E as THE or A-N-D as AND). If this question seems confusing to you, ask your supervisor to help explain it better.

On average I never or rarely group these pieces	On average I group these pieces less than half the time	On average I group these pieces more than half the time	On average I always or almost always group these pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

38. LETTERS-->AUTHOR: Think about entering names in the AUTHOR field. On the scale below, estimate the percent of the time (on the average) you tend to enter separate letters as if they were a single chunk representing an author's name (e.g., S-M-I-T-H as SMITH or J-O-N-E-S as JONES).

On average I never or rarely group these pieces	On average I group these pieces less than half the time	On average I group these pieces more than half the time	On average I always or almost always group these pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

39. LETTERS-->KEY WORD: Think about entering key words in the KEY WORDS field. On the scale below, estimate the percent of the time (on the average) you tend to enter separate letters as if they were a single chunk representing a key word (e.g., G-O-A-L as GOAL or T-H-E-O-R-Y as THEORY).

On average   On average I   On average I   On average
I never or   group these   group these   I always or
rarely group   pieces less   pieces more   almost always
these pieces   than half the   than half the   group these
                   time   time   pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

40. LETTERS-->TITLE WORD: Think about entering data in the TITLE field. On the scale below, estimate the percent of the time (on the average) you tend to enter separate letters as if they were a single chunk of information in the title (e.g., J-O-B as JOB or W-O-R-K as WORK).

On average   On average I   On average I   On average
I never or   group these   group these   I always or
rarely group   pieces less   pieces more   almost always
these pieces   than half the   than half the   group these
                   time   time   pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

41. LETTERS-->LOCATION: Think about entering data in the LOCATION field. On the scale below, estimate the percent of the time (on the average) you tend to enter separate letters as if they were a single location (e.g., L-I-B-R-A-R-Y as LIBRARY or N-E-B-E-K-E-R as NEBEKER).

On average   On average I   On average I   On average
I never or   group these   group these   I always or
rarely group   pieces less   pieces more   almost always
these pieces   than half the   than half the   group these
                   time   time   pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

42. DIGITS-->YEAR: Think about the YEAR field. On the scale below, estimate the percent of time (on the average) you tend to enter separate digits as a single year (e.g., 1-9-8-5 as 1985 and not individual digits).

| On average I never or rarely group these pieces | On average I group these pieces less than half the time | On average I group these pieces more than half the time | On average I always or almost always group these pieces |

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

43. DIGITS-->PAGES: Think about the PAGES field. On the scale below, estimate the percent of time (on the average) you tend to enter separate digits as a single page reference (e.g., 1-0-1-1-0-9 as a single page reference 101-109 and not separate digits).

| On average I never or rarely group these pieces | On average I group these pieces less than half the time | On average I group these pieces more than half the time | On average I always or almost always group these pieces |

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

44. WORDS-->STRING: Think about all the fields taken together. On the scale below, estimate the percent of the time (on the average) you tend to enter separate words as if they were a complete string or phrase and not individual words (e.g., JOB-DESIGN as a single string or DECISION-MAKING-THEORY as one continuous phrase).

| On average I never or rarely group these pieces | On average I group these pieces less than half the time | On average I group these pieces more than half the time | On average I always or almost always group these pieces |

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

45. FIELDS-->CLUSTERS: Think about all of the fields taken together. On the scale below, estimate the percent of time (on the average) you tend to enter separate fields as a single cluster of fields (e.g., City = Los Angeles and State = CA get combined into one City/State cluster; or the same two authors always occur together and they get entered as a single unit or cluster).

On average I never or rarely group these pieces	On average I group these pieces less than half the time	On average I group these pieces more than half the time	On average I always or almost always group these pieces

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

Type in a number from 0 to 100 and then press ENTER

AUTOMATICITY

After a while some information becomes repetitive and a worker learns to enter it almost unconsciously. We have found that some of the fields (e.g., journal, city, state) become so familiar that as soon as the operator see the information he or she can enter it almost without thinking. What follows is a list of the different fields. For each field, rate on a 5-point scale the degree to which the information can be entered automatically.

46.   Authors

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2 3	4 5

Please type a number from 1 to 5 and then press ENTER

47.   Title

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2 3	4 5

Please type a number from 1 to 5 and then press ENTER

48.   Year

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

              1   2   3   4   5

              Please type a number from 1 to 5 and then press ENTER

49.   Month

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

              1   2   3   4   5

              Please type a number from 1 to 5 and then press ENTER

50.   Day

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

              1   2   3   4   5

              Please type a number from 1 to 5 and then press ENTER

51.   Journal

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

              1   2   3   4   5

              Please type a number from 1 to 5 and then press ENTER

52.   Volume

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

        Please type a number from 1 to 5 and then press ENTER

53.   Monograph

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

        Please type a number from 1 to 5 and then press ENTER

54.   Pages

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

        Please type a number from 1 to 5 and then press ENTER

55.   Key Words

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

        Please type a number from 1 to 5 and then press ENTER

56.   Location

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

          1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

57.   Report Number

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

          1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

58.   City

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

          1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

59.   State

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

          1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

60.   Institution

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

61.   Deposit Service

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

62.   Editor

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

63.   Edition

This field requires   This field requires   This field requires
great thought and I   some thought but I   hardly any thought
must concentrate very   do not have to be   and I can enter the
hard to enter the data   constantly on my toes   data automatically

        1   2   3   4   5

            Please type a number from 1 to 5 and then press ENTER

64.   Publisher

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2	3	4	5

Please type a number from 1 to 5 and then press ENTER

65.   Issue Number

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2	3	4	5

Please type a number from 1 to 5 and then press ENTER

66.   Abstract Service

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2	3	4	5

Please type a number from 1 to 5 and then press ENTER

67.   Microfilm Number

This field requires great thought and I must concentrate very hard to enter the data	This field requires some thought but I do not have to be constantly on my toes	This field requires hardly any thought and I can enter the data automatically
1	2	3	4	5

Please type a number from 1 to 5 and then press ENTER

WORK BREAKS

The following questions ask you about work breaks. A work break is any time you use the OP (PAUSE) keys from the MAIN MENU or the T (TIME OUT) key from the QUIT MENU. Answer the following questions about work breaks you have taken during the past two weeks only. Many of the questions will be repeated twice. The first question will ask about the first week on the job and the second question will be identical to the first except it will ask about the last week on the job.

68. During the first week of this job when you took work breaks, how long was the average work break (in minutes)?

Type your response and then press ENTER

69. During the last week of this job when you took work breaks, how long was the average work break (in minutes)?

Type your response and then press ENTER

70. During the first week of this job when you took work breaks, how frequently did you take breaks (number of breaks per day)?

Type your response and then press ENTER

71. During the last week of this job when you took work breaks, how frequently did you take breaks (number of breaks per day)?

Type your response and then press ENTER

72. During the first week of this job what was the major reason for taking work breaks?
(1) stretch and move around
(2) go to the washroom
(3) go to the snack shop
(4) smoke
(5) go outside for sun, fresh air, etc.
(6) rest
(7) do something different
(8) other (type 8 then write short reply on the note pad at your desk)

Type your response and then press ENTER

73. During the last week of this job what was the major reason for taking work breaks?
(1) stretch and move around
(2) go to the washroom
(3) go to the snack shop
(4) smoke
(5) go outside for sun, fresh air, etc.
(6) rest
(7) do something different
(8) other (type 8 then write short reply on the note pad at your desk)

Type your response and then press ENTER

74. During the first week of this job when you took work breaks, did you usually (1) leave your work station, or (2) stay at your work station?

Type your response and then press ENTER

75. During the last week of this job when you took work breaks, did you usually (1) leave your work station, or (2) stay at your work station?

Type your response and then press ENTER

WORK PACE ESTIMATES

No one can operate at their fastest pace all the time; nor do we operate at the same pace continually. We speed up or slow down because of things like energy and fatigue, interest and boredom, problems or delays, etc. During a regular work day we may go at our fastest pace for a while and at other times we slow down and sometimes we stop for a break. The next few questions concern your estimate of what your key rate would be for entering JOURNAL REFERENCES if you worked at the different paces listed below for a full shift. To help you make this estimate we can tell you that the slowest person rarely falls below 2000 keystrokes per hour and the fastest person rarely exceeds 8000 keystrokes per hour. The average person on an average day does about 4000 keystrokes per hour which is a typing speed of about 30 words per minute.

76. How many keystrokes per hour would you average if you worked at your slowest pace for a full shift entering JOURNAL REFERENCES? (Remember that the average worker does about 4000 keystrokes per hour which is about 30 words per minute.)

Type keystrokes per hour and then press ENTER

77. How many keystrokes per hour would you average if you worked at your normal pace for a full shift entering JOURNAL REFERENCES? (Remember that the average worker does about 4000 keystrokes per hour which is about 30 words per minute.)

Type keystrokes per hour and then press ENTER

78. How many keystrokes per hour would you average if you worked at your fastest pace for a full shift entering JOURNAL REFERENCES? (Remember that the average worker does about 4000 keystrokes per hour which is about 30 words per minute.)

Type keystrokes per hour and then press ENTER

79. On the scale below, estimate the degree to which you vary your pace during a full shift of entering JOURNAL REFERENCES.

My pace varies a lot during a shift	My pace varies somewhat during a shift	My pace varies a little during a shift	My pace is very steady during a shift

1   2   3   4   5   6   7   8   9   10   11   12   13   14   15

Type in a number from 1 through 15 and then press ENTER

ERROR CORRECTION

80. During the first week of this job which of the following techniques did you use most frequently when you made errors on the documents in a batch?

1. Entered all documents in a batch first, then went back to modify the incorrect ones.

2. Alternated between entering a few documents in a batch and then modifying the incorrect ones.

3. Didn't use the modify option because I corrected documents as I went along (i.e., I checked the article before pressing Y, and if it needed correcting I did it then).

4. I didn't make errors.

5. I didn't correct errors when I made them.

Type your response and then press ENTER

81. During the last week of this job which of the following techniques did you use most frequently when you made errors on the documents in a batch?

1. Entered all documents in a batch first, then went back to modify the incorrect ones.

2. Alternated between entering a few documents in a batch and then modifying the incorrect ones.

3. Didn't use the modify option because I corrected documents as I went along (i.e., I checked the article before pressing Y, and if it needed correcting I did it then).

4. I didn't make errors.

5. I didn't correct errors when I made them.

Type your response and then press ENTER

FUNCTION KEYS

A list of keys and their functions will follow. We would like to know about how often you use each of these keys in an hour. To help you make this judgment we have estimated that the average person uses the ENTER key about 100 times per hour. Estimate how often you use each of the following keys by comparing them to the ENTER key. The list of keys will be presented twice. The first time through, reflect on the first week of this job and make your estimates based on how often you used the keys during the first week.

82. End = go to the end of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

83. R = the repeat key for entering documents (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

84. ctrl^Y = delete from the cursor to the end of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

85. PgDn = go to the bottom of the screen (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

86. Ins = insert mode/overtype mode (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

87. Home = go to the beginning of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

88. Del = delete a character (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

89. Backspace (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

90. Shift (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

91. Direction = arrow keys (if I use the ENTER key 100 times per hour, I probably use these keys _____ times per hour).

Now the same list of keys will be presented again. This time reflect on the last week of this job and make your estimates based on how often you used the keys during the last week. As before, base your estimate on a comparison with the ENTER key.

92. End = go to the end of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

93. R = the repeat key for entering documents (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

94. ctrl^Y = delete from the cursor to the end of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

95. PgDn = go to the bottom of the screen (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

96. Ins = insert mode/overtype mode (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

97. Home = go to the beginning of the field (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

98. Del = delete a character (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

99. Backspace (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

100. Shift (if I use the ENTER key 100 times per hour, I probably use this key _____ times per hour).

101. Direction = arrow keys (if I use the ENTER key 100 times per hour, I probably use these keys _____ times per hour).

RESOURCE USE
102. During the first week of this job how many time per day (on the average) did you use your work manual to answer questions about your work?

Type your response and then press ENTER

103. During the last week of this job how many time per day (on the average) did you use your work manual to answer questions about your work?

Type your response and then press ENTER

104. During the first week of this job how many times per day (on the average) did you consult a supervisor about your work?

Type your response and then press ENTER

105. During the last week of this job how many times per day (on the average) did you consult a supervisor about your work?

Type your response and then press ENTER

106. During the first week of this job how many times per day (on the average) did you consult a coworker about your work?

Type your response and then press ENTER

107. During the last week of this job how many times per day (on the average) did you consult a coworker about your work?

Type your response and then press ENTER

GOALS

Sometimes people set goals for themselves when they work on a job. For example, some people try for a certain production rate, others try to put out a certain amount of effort, and others try to maintain a certain level of quality. The following questions ask about the goals or objectives you may have set.

108. I gave some thought to setting a goal for my production rate.

Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

109. I gave some thought to setting a goal about how hard I would work

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

110. I gave some thought to setting a goal for the quality of my work

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

The next five questions ask you about production rate goals you might have set. The questions ask you to rate your agreement for goals which range from being the slowest worker at one extreme to being the fastest worker at the other extreme.

111. My goal was to be the slowest worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

112. My goal was to work faster than the slowest worker but slower than the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

113. My goal was to work as fast as the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

114. My goal was to work faster than the average worker but slower than the fastest worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

115. My goal was to be the fastest worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

116. My goal was to work as fast as I could

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

117. My goal was to have an average key entry rate of _____ (if this question does not apply to you, type NA then press ENTER).

Type keystrokes per hour and then press ENTER

A-26

118. My goal was to have a key entry rate no lower than _____ (if this question does not apply to you, type NA then press ENTER).

　　　Type keystrokes per hour and then press ENTER

119. My goal was to have a key entry rate no higher than _____ (if this question does not apply to you, type NA then press ENTER).

　　　Type keystrokes per hour and then press ENTER

The next five questions ask you about effort goals you might have set. The questions ask you to rate your agreement for goals ranging from the laziest worker at one extreme to the hardest worker at the other extreme.

120. My goal was to be the laziest worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

　　　Type in a number from 1 to 5 and then press ENTER

121. My goal was to work harder than the laziest worker, but not as hard as the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

　　　Type in a number from 1 to 5 and then press ENTER

122. My goal was to work as hard as the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

　　　Type in a number from 1 to 5 and then press ENTER

123. My goal was to work harder than the average worker, but not as hard as the hardest working worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

124. My goal was to work harder than any other worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

125. My goal was to work as hard as I could

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

126. My goal was to work at a comfortable, relaxed pace

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

The next five questions ask you about quality goals you might have set. The questions ask you to rate your agreement for goals ranging from being the sloppiest worker at one extreme to the most accurate worker at the other extreme.

127. My goal was to be the sloppiest worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

128. My goal was to be more accurate than the sloppiest worker, but not as accurate as the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

129. My goal was to be as accurate as the average worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

130. My goal was to be more accurate than the average worker, but not as accurate as the most accurate worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

131. My goal was to be the most accurate worker

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

132. My goal was to be as accurate as I could

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

PERFORMANCE REPORTS

The next set of questions ask you about various ways in which you used the performance reports. Many of the questions will be repeated twice. The first question will ask about the first week on the job and the second question will be identical to the first except that it will ask about the last week on the job.[1]

133. During the first week of this job when were you most likely to look at performance reports?
1. Just before a break.
2. After completing a batch.
3. In the middle of a batch.
4. At the end of the day only.
5. After a certain amount of time had passed (if you choose
    this item just type the approximate number of minutes you
    would usually wait before looking at a report).

Type your response and then press ENTER

134. During the last week of this job when were you most likely to look at performance reports?
1. Just before a break.
2. After completing a batch.
3. In the middle of a batch.
4. At the end of the day only.
5. After a certain amount of time had passed (if you choose
    this item just type the approximate number of minutes you
    would usually wait before looking at a report).

Type your response and then press ENTER

---

[1] Questions 133-145 were not presented to the first control group.

135. During the first week of this job which performance report did you look at most frequently?
(1) TASK REPORT (2) BATCH REPORT (3) PROGRESS REPORT (4) DAY REPORT

        Type your response and then press ENTER

136. During the last week of this job which performance report did you look at most frequently? (1)
TASK REPORT (2) BATCH REPORT (3) PROGRESS REPORT (4) DAY REPORT

        Type your response and then press ENTER

137. During the first week of this job what did you typically do with the information you obtained
from the performance reports?
1. Used it to improve my performance
2. Shared it with some of my coworkers
3. Used it to figure out how much I earned
4. Compared results with previous reports
5. Ignored it
6. Other (type 6 then write a short description on the note pad at your desk)

        Type your response and then press ENTER

138. During the last week of this job what did you typically do with the information you obtained
from the performance reports?
1. Used it to improve my performance
2. Shared it with some of my coworkers
3. Used it to figure out how much I earned
4. Compared results with previous reports
5. Ignored it
6. Other (type 6 then write a short description on the note pad at your desk)

        Type your response and then press ENTER

139. During the first week of this job how often did you look at performance reports (number of
times per day)?

        Type your response and then press ENTER

140. During the last week of this job how often did you look at performance reports (number of
times per day)?

        Type your response and then press ENTER

141. During the first week of this job which one of the following items on the performance reports did you look at most often (select one item only and enter its number)?

1. RECORD COUNT
2. KEY COUNT
3. KEY TIME
4. KEY RATE
5. PROD HRS
6. REG HRS
7. EXPND HRS
8. REG PAY
9. BEST RATE
10. TASK TIME

   Type one choice only and then press ENTER

142. During the last week of this job which one of the following items on the performance reports did you look at most often (select one item only and enter its number)?[2]

1. RECORD COUNT
2. KEY COUNT
3. KEY TIME
4. KEY RATE
5. PROD HRS
6. REG HRS
7. EXPND HRS
8. REG PAY
9. BEST RATE
10. TASK TIME
    Type one choice only and then press ENTER

---

[2] Question asked of the second control group.

143. During the last week of this job which one of the following items on the performance reports did you look at most often (select one item only and enter its number)?[3]

1. RECORD COUNT
2. KEY COUNT
3. KEY TIME
4. KEY RATE
5. KEY EFF
6. TIME EFF
7. TOTAL EFF
8. PROD HRS
9. REG HRS
10. EXPND HRS
11. STD RT
12. REG PAY
13. BEST RATE
14. BEST EFF
15. TASK TIME

Type one choice only and then press ENTER

144. During the first week of this job how many times did you ask for a printout of a report at the end of the day?

Type your response and then press ENTER

145. During the last week of this job how many times did you ask for a printout of a report at the end of the day?

Type your response and then press ENTER

BACKGROUND INFORMATION

Please answer the following questions about yourself:

146. What is your age (in years)?

Type your response and then press ENTER

147. What is your gender (0 = male, 1 = female)?

Type your response and then press ENTER

---

[3] Question asked of the standards groups only. Items 5,6,7 and 14 express keystroke rate as a percent of the standard (efficiency). Item 11 is the standard rate for the worker.

148. What is your marital status (1 = single, 2 = married, 3 = divorced, separated, or widowed)?

Type your response and then press ENTER

149. How many dependents do you have (enter 0 for none)?

Type your response and then press ENTER

150. What is your ethnic background (1 = Caucasian, 2 = Afro-American, 3 = Asian, 4 = Hispanic, 5 = Other--type 5 then write short description on the pad at your desk)

Type your response and then press ENTER

151. Have you taken a typing class (0 = no, 1 = yes)?

Type your response and then press ENTER

152. How many words per minute could you type before this job?

Type your response and then press ENTER

153. Had you ever used a word processor before taking this job (0 = no, 1 = yes)?

Type your response and then press ENTER

154. Education
0 = H. S. Graduate
1 = 1 Yr College
2 = 2 Yr College
3 = 3 Yr College
4 = 4 Yr College
5 = More than 4 years of college
6 = College Graduate
7 = Postgraduate

Type in the number corresponding to highest
level achieved and then press ENTER

155. Have you ever held a full-time job (0 = no, 1 = yes)?

Type your response and then press ENTER

156. If you have held a full-time job, what kind of job was your highest paying job? (Write down job title on the pad at your desk and then enter an abbreviation of no more than six letters. Type NA if not applicable.)

Type your response and then press ENTER

157. If you have held a full-time job, what was the hourly rate for your highest paying job (type dollars per hour or NA if not applicable)?

Type your response and then press ENTER

158. Answer this question if you have never held a full-time job: What kind of job was your highest paying part-time job before this job? (Write down job title on the pad at your desk and then enter an abbreviation of no more than six letters. Type NA if not applicable.)

Type your response and then press ENTER

159. Answer this question if you have never held a full-time job: What was the hourly rate for your highest paying part-time job before this job? (type dollars per hour or NA if not applicable)?

Type your response and then press ENTER

160. Is this the first job (full-time or part-time) that you have ever had (0 = no, 1 = yes)

Type your response and then press ENTER

161. Do you think your work on this job represents your typical work behavior? (0 = no, 1 = yes)

Type your response and then press ENTER

162. How did you perceive the general work environment?

Seems like a normal job		Seems like an equal balance between a normal job and research		Seems like a research project
1	2	3	4	5

Type in a number from 1 to 5 and then press ENTER

APPENDIX B

DETAILED DESCRIPTION OF WORK STRATEGY MEASURES AND ANALYSIS

DETAILED DESCRIPTION OF WORK STRATEGY MEASURES AND ANALYSIS

The following is a detailed description of the measures and analysis of the work strategy data. The tables discussed in this Appendix refer to Tables 2 and 3 in the body of the report.

Task Strategies

These strategies relate to how the workers structure the motor and cognitive components of a task. For a key entry task such as this, the motor components relate to the positioning of the hands and fingers and to eye movements.

Hand Position

The results from the questionnaire, as depicted in Table 2, demonstrated that a greater percentage of workers in the high standards group used a more efficient hand and finger position (use of all 10 fingers and heels of hands poised above the keyboard) when they typed compared with that of the other two groups. However, these observed differences failed to reach statistical significance, $X^2(2, N = 34) = 2.77, p > .25$. Table 3 shows a significant correlation between hand position and productivity.

Eye Movements

The results from Table 2 also show that a greater percentage of high standards workers employed more effective eye movements (they more often looked from the document to the screen rather than looking from document to keyboard to screen) than the other two groups. These differences were statistically significant, $X^2(2, N = 34) = 6.60, p < .04$. Individual contrasts showed that the high standards group was significantly different from the control group ($p < .05$), but there was no difference between the low standards group and the control groups ($p > .20$). Table 3 shows a significant correlation between eye movements and productivity.

There are two task strategies shown in Table 2 that are cognitive in nature, chunking and automaticity.

Chunking

Chunking reflects the degree to which a person can form a higher order unit of information from pieces of information at a lower level. For example, rather than entering an author's name as two separate names (first and last), an experienced typist can often combine the two pieces of information into a single, higher order chunk, and enter the entire name as a single unit. The chunking scale reflects the degree of chunking averaged across the eight different scales (see Appendix A), with higher values reflecting a greater degree of chunking. Statistical analysis failed to reveal any differences among

the groups, F (2, 31) < 1.00. Table 3 shows that the overall degree of chunking was not significantly correlated with productivity.

Automaticity

The second cognitive strategy, automaticity, reflects the degree to which a person can enter data in a fashion that requires little concentration. The scale values were averaged over 22 separate scales (see Appendix A). Low values meant that the subjects had to concentrate a great deal on their work; high values meant that there was greater automaticity to their work, and concentrated, controlled processing was not required. The results from Table 2 show that the high standards group was able to "automatically" process and enter the information to a greater extent than the control group, whereas the low standards group was less capable of automatic processing than the control group. The results of the overall regression analysis revealed that these differences among the groups were significant, F (2, 30) = 3.54, p < .05, but only the contrast between the low standards group and the control group was reliable (p < .05). Table 3 shows that automaticity was significantly related to productivity.

Support Strategies

Support strategies relate to methods the worker uses to support the cognitive and motor skills required for the task.

Rest Periods

The first support strategy listed in Table 2, rest periods, illustrates what is meant by a support strategy. Workers can support their work on a task by structuring the rest periods during the day. If a worker takes few work breaks during the day, then he or she runs the risk of becoming fatigued and the work will suffer. On the other hand, if the worker takes too many work breaks, then his or her time efficiency will decline and productivity again will suffer. There are two measures of rest periods--objective and subjective--listed in Table 2. The objective measure of rest periods is the total time the worker spent per day on work breaks as recorded by the computer. Each time the worker wanted to take a break, he or she was asked to select a special menu item from the screen that would start a clock. When the worker ended the break and returned to regular task activities, the software automatically logged the break completion time. The computer would then store the information on the frequency of breaks and the total amount of time on breaks each day. The validity of these data is dependent, of course, on whether the workers were selecting the break item on the menu as required. Spot checks by the researchers gave no indication that workers did not abide by this system.

The differences for the objective (computer-monitored) measures of rest period time (measured in minutes) shown in Table 2 are statistically significant, F (2, 35) = 7.56, p < .002. The low standards group spent significantly more time on breaks than the control group (p < .001), but there was no difference between the high standards and

control groups ($p > .10$). It is interesting that Table 2 shows the high standards group selecting an intermediate level of rest period time. Although we have no way of knowing what the "optimal" work break schedule is, it is possible that the level selected by the high standards group is closer to optimal than the levels selected by either the control group or the low standards group. These objectively measured work breaks did not correlate significantly with productivity (see Table 3).

The subjective measure of rest periods was acquired by asking the subjects to estimate the frequency and length of their work breaks. By multiplying the frequency and length values for each subject we derived a subjective estimate of total work-break time for each subject. As shown in Table 2, these subjective times (measured in minutes) were very close to the actual times recorded by the computer, but the analysis failed to reveal any significant differences among the groups, $F(2, 31) = 2.68, p > .09$. This lack of significance for the subjective measures may be related to the greater variability of these subjective measures compared with the more objective computer values. As with the objective measure, the subjective measure of work breaks was not related to productivity, as shown in Table 3.

Pace

The other support strategies listed in Table 2 all conform to the same general principle as rest periods, that is, they all support, in one way or another, the worker's task performance. Pace is the next support strategy and refers to the speed with which a person performs the work. Generally, if one is working at a fast speed, he or she is putting forth more effort than if working at a slow speed. Speed is relative, however, and a given speed may be effortful for one person and easy for another. In this research, pace refers to the optimal, or normal, speed for a person. To use a simple analogy, pace is like the cruising speed on a car. We all work at a particular speed we find comfortable or "optimal." This speed falls within a "comfort zone"; a faster speed is too stressful or effortful for us, and a slower pace unnatural. This comfort zone can vary from time to time and from situation to situation. For example, runners frequently note that on some days a speed feels comfortable, whereas on other days the same speed is difficult. For runners, the excitement of a race often allows them to run at speeds that would be unbearably strenuous on a normal training day. In the context of this research, it is possible that having a high standard to meet may allow a person to adjust his or her normal pace upward without falling outside this comfort zone. Likewise, being assigned a low standard may lead the person to adjust his or her normal pace downward.

Obviously pace, as defined here, is not an easy dimension to measure. By pace we do not mean effort per se (i.e., how hard the person works) because a person's optimal pace will be at a constant, moderate level of effort. Also, pace is not the same as the keystroke rate, the measure of productivity in this research. What is meant by pace in this study is the person's normal keystroke rate at a preferred level of effort. To capture this dimension, we had the subjects estimate their keystroke rate at their "normal pace"

(see question 77 in Appendix A). We then formed a ratio of this reported pace value to an estimate of the worker's keyrate "capacity." Because we had no way of determining this capacity directly, we estimated the capacity by averaging three different measures: (a) the second work sample score, (b) the reported keyrate at the fastest pace (see question 78 in Appendix A), and (c) the average keyrate during the second week divided by the worker's effort estimate during the second week (question 34 in Appendix A). The ratio of normal pace to capacity was then multiplied by the average capacity score to obtain a value expressed in keystrokes per hour. These keyrates reflected the workers' normal, comfortable pace adjusted for differences in keyrate capacity.

Once again the results of the questionnaire are highly suggestive. The overall regression analysis was significant, F (2, 30) = 6.43, $p < .005$. Table 2 shows that the high standards group had a slightly lower normal pace than the control group, and the low standards group had a considerably lower normal pace than the control group. Only the contrast between the low standard group and the control group was significant ($p < .04$). The data suggests that high standards do not elevate one's normal pace but low standards may depress this pace. Table 3 shows that pace was not significantly correlated with productivity.

Persistence

Table 2 shows persistence as the next strategy. Persistence refers to the stability of one's work pace. Persistence was measured in this study by asking subjects to rate the degree to which they varied their pace during the course of a typical day. Based on this scale of persistence, the ordering of the groups is suggestive. It looks as though the high standards group was the most persistent at maintaining a stable pace (i.e., they reported the least variability in their pace), but none of the differences in Table 2 were significant, F (2, 31) < 1.00. Table 3 also shows that this measure of persistence was not correlated with productivity.

Time Management

The next strategy shown in Table 2 is time management; that is, the way in which workers use their time in an attempt to foster higher productivity. About the only time management operation available in key entry work is the way in which workers choose to correct mistakes. One strategy is to correct mistakes as they occur, on a continuous basis. A second strategy involves alternating between entering a set of documents and then going back over them later to correct the mistakes. The continuous strategy is more efficient than the alternating strategy because continuous corrections require fewer operations (e.g., the worker does not have to scan the documents a second time looking for errors). Table 2 shows the percent of subjects in each group who chose the alternating strategy. It can be seen that almost half the workers in the control group chose the inefficient, alternating strategy, whereas very few of the workers in the low and high standards groups chose this strategy. The analysis showed that there were significant

differences in the selection of this strategy, $X^2(2, N = 30) = 8.24, p < .02$. Both the contrast between the high standards group and the control and the contrast between the low standards group and the control were significant ($p < .05$). Table 3 shows that the correlation between this strategy and productivity was not statistically significant.

Resource Management

Resource management is another support strategy shown in Table 2 and relates to the number of resources a worker uses to perform the job. In the present study we created an index of how many work resources a person used per hour. We gathered estimates of the workers' use of their work manual, their supervisors, coworkers, and the available keys on the keyboard. Table 2 shows that the high standards group used fewer resources than the other two groups, but none of these differences were statistically significant $F (2, 27) < 1.00$, and the correlation with productivity was not significant, as shown in Table 3.

Self-set Goals

The next support strategy listed in Table 2 is self-set production goals. The questionnaire (Appendix A) asked the subjects if they set specific production goals for the task and, if so, to state the level of the goal in terms of keystroke rate. Sixteen of the 34 subjects who received the questionnaire reported setting a production goal (one subject stated the goal in terms of a range of values and so we used the midpoint as a single value). The difficulty of these goals was determined by taking the level of the goal reported and adjusting this value by the subject's ability (work sample) using the residual gain analysis described earlier for other adjusted measures in this study. Table 2 shows that the control groups reported setting more difficult production goals than either of the other two groups and that the low standards group set the least difficult goals. However, none of the differences for the production goals were significant, $F (2, 13) < 1.00$. Table 3 shows that there was a nonsignificant correlation between the level of goal difficulty and productivity.

Feedback

The last support strategy is feedback seeking. The measure in Table 2 refers to the total time per day (in minutes) the workers spent looking at performance reports. Each time a worker called up a computer-generated report, the machine would start a clock. The clock would run until the worker pressed a special key that returned the person back to the data entry task. Table 2 seems to show that the high standards group spent more time looking at reports (and presumably obtaining useful diagnostic information) than either the low standards or the control group. These differences failed to achieve statistical significance, $F (2, 25) = 1.14, p > .30$, and, as shown in Table 3, there was no correlation between this measure of feedback and productivity. None of the questionnaire items (Appendix A) relating to feedback revealed any significant differences between the three groups.

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